

Claims:

1. A foundation for mounting an offshore structure, the foundation comprising a socket for receiving and retaining an end part of the structure, the socket having a
5 base surface, an intermediate supporting part and an upper body having an internal guiding surface for guiding said end part into the intermediate supporting part, said guiding surface also forming a reaction surface operatively co-operating with alignment means of the structure for alignment of the structure when
10 inserted in the foundation.
2. A foundation as claimed in claim 1 wherein said guiding surface is frusto-conical.
3. A foundation as claimed in claim 1 or 2 wherein said intermediate supporting part
15 has a substantially cylindrical inner surface sized to conform with a corresponding outer surface of said end part.
4. A structure for mounting in the foundation of any of claims 1 to 3, said structure
20 comprising an end part for insertion into the socket of the foundation, said end part having alignment means mounted on said end part operative to co-operate with said guiding surface when said end part is in the socket to align the structure into a desired alignment.
5. A structure as claimed in claim 4 wherein the alignment means are removable.
- 25 6. A structure as claimed in claim 4 or 5 wherein the outer surface of the end part is substantially cylindrical.
7. A structure as claimed in claim 4, 5 or 6 wherein the end part further includes a
30 leading end portion of substantially conical shape.

8. A structure as claimed in claim 7 wherein a curved, substantially spherical or part spherical element is disposed on the tip of the leading end portion whereby the conical leading end portion is prevented from fully abutting the base surface of the socket.
- 5
9. A foundation as claimed in any of claims 1 to 3 for co-operation with a structure as claimed in claim 7 or 8 wherein the base surface of the socket is of substantially conical shape to generally conform with the conical leading end portion of the structure.
- 10
10. The combination of a foundation for mounting an offshore structure and a structure mountable in the foundation, wherein the structure comprises an end part having a leading end portion of substantially conical shape and alignment means located on the leading end part, the foundation comprising a socket
- 15
- comprising a base surface of substantially conical shape sized substantially to conform with the substantially conical end portion, an intermediate supporting part and an upper body having an internal guiding surface wherein the socket operatively receives the leading end part such that the conical base surface and the conical end portion are in juxtaposition and the internal guiding surface
- 20
- operatively provides a reaction surface against which the alignment means operatively act for adjustment of the structure into a desired alignment.
11. A combination as claimed in claim 10 wherein the alignment means are removeable.
- 25
12. A combination as claimed in claim 10 or 11 wherein the internal guiding surface is frusto-conical.
13. A combination as claimed in claim 10, 11 or 12 wherein the inner surface of the
- 30
- intermediate supporting part and the outer surface of the end part of the structure are cylindrical.

14. A combination as claimed in claim 13 wherein said inner and outer surfaces are spaced apart in use.
- 5 15. A combination as claimed in any of claims 10 to 14 wherein a curved, substantially spherical or part spherical element is disposed on the tip of the leading end portion whereby the conical leading end portion is prevented from fully abutting the conical base surface of the socket.
- 10 16. Apparatus for mounting a structure as claimed in any of claims 4 to 8 in a foundation as claimed in any of claims 1 to 3 or 9, the apparatus comprising a transporting barge, means for retaining the structure on the barge during transportation in a reclined position, means for moving the structure from the reclined position to an upright position and for lowering the structure in said
15 upright position over the side of the barge, and a guide wire attachable to the end of the structure for guiding the leading end of the structure into the socket.
17. An apparatus as claimed in claim 16 wherein the means for moving the structure from the reclined position to an upright position comprises a cable-stayed "A"
20 frame.
18. An apparatus as claimed in claim 16 or 17 wherein the structure is retained while in its upright position, and lowered, by means of one or more clamps engaging the structure.
25
19. An apparatus as claimed in any of claims 16 to 18 further comprising means for supplying grout to the joint between the end part of the structure and the socket.
20. An apparatus as claimed in claim 19 wherein the means comprise supply hoses
30 which are operatively disconnectable from the a supply of grout and are sealable,

the apparatus further comprises a buoy to which the supply hoses may be attached after disconnection from the supply of grout.

21. An apparatus as claimed in any of claims 16 to 20 further comprising means for recovering the alignment means after the structure has been mounted in the foundation.

22. A method of mounting an offshore structure in a sub-surface foundation, the method comprising:
- 10 i) providing a sub-surface foundation as claimed in any of claims 1 to 3 or 9;
 - ii) providing a structure as claimed in any of claims 4 to 8 and supporting the structure in a reclined position on a barge;
 - iii) providing a winched cable stayed A frame on the barge and moving the structure from the reclined position to an upright position by means of the A
 - 15 frame;
 - iv) supporting the structure in its upright position by means of clamps attached to the A frame;
 - v) attaching a guide wire to a end part of the structure and guiding the end part of the structure into the socket of the foundation by means of the guide wire;
 - 20 vi) lowering the alignment means down the end part of the structure until the alignment means engage the internal guiding surface of the upper body of the socket and adjusting the alignment of the structure by means of the alignment means acting on the internal guiding surface until a desired alignment is achieved; and
 - 25 vii) releasing the clamps supporting the structure.

23. A method as claimed in claim 22 further comprising the steps of:
- viii) providing grout injection hoses and injecting grout into the joint between the structure and the socket;
 - 30 ix) sealing the grout injection hoses; and
 - x) attaching the sealed clamp hoses to a surface buoy.

24. A method as claimed in claim 23 including the further step of
- xi) recovering the grout injection hoses and/or the alignment means when the grout in the joint has set.
- 5
25. A method substantially as hereinbefore described with reference to any of Figures 1 to 10.
26. A combination substantially as hereinbefore described with reference to any of
- 10 Figures 3 to 10.
27. A structure substantially as hereinbefore described with reference to any of figures 1 to 10.
- 15 28. An apparatus substantially as hereinbefore described with reference to any of figures 1 to 5, 7 or 8.